

**What is claimed is:**

1. A modular plastic structural composite comprising a web section disposed  
5 along a horizontal axis and at least one flange section disposed along a horizontal axis  
parallel thereto and integrally molded to engage the top or bottom surface of said web  
section, wherein said composite is formed from a mixture of (A) high density polyolefin and  
(B) a thermoplastic-coated fiber material, polystyrene, or a combination thereof.

10 2. The modular plastic structural composite of claim 1, wherein said high-density  
polyolefin is high-density polyethylene (HDPE).

3. The modular plastic composite of claim 1, wherein said thermoplastic-coated  
15 fiber material is a thermoplastic-coated carbon or glass fiber.

4. The modular plastic composite of claim 1, wherein the vertical dimension  
(thickness) of the flange section is about one-tenth to about one-half the size of the vertical  
dimension of the web section without any flange section(s).

20 5. The modular plastic composite of claim 1, wherein the width dimension of the  
entire flange section measured perpendicular to the horizontal axis of the flange section is  
about two to about ten times the size of the width dimension of the web section measured  
perpendicular to the horizontal axis of the web section.

25 6. The modular plastic composite of claim 1, characterized by being an I-Beam.

7. The modular plastic composite of claim 1, characterized by being a C-Beam.

8. The modular plastic composite of claim 1, characterized by being a T-Beam.

30 9. An essentially planar modular plastic structural composite comprising a  
grooved side and an integrally molded tongue-forming side, each side perpendicular to the  
plane of the composite, in which the composite is formed from a mixture of (A) high-  
density polyolefin and (B) a thermoplastic-coated fiber material, polystyrene, or a  
35 combination thereof, wherein the grooved side defines a groove and the tongue-forming

side is dimensioned to interlockingly engage a groove having the dimensions of the groove defined by the grooved side, and the grooved side and tongue-forming side are dimensioned so that a plurality of the essentially planar modular plastic structural composites may be interlockingly assembled to distribute a load received by one assembly member among  
5 other assembly members.

10. The planar modular plastic composite of claim 9, comprising at least one pair of parallel opposing grooved and tongue-forming sides, defining therebetween a width or length dimension of the composite.

11. The planar modular plastic composite of claim 10, wherein said width dimension is between about two and about ten times the size of the height (thickness) dimension of the composite.

12. A bridge constructed from the I-Beams of claim 6, comprising a plurality of pier-supported parallel rows of larger first I-Beams, and a plurality of smaller second I-beams disposed parallel to one another and fastened perpendicular to and between adjacent rows of the larger first I-Beams, wherein the top and bottom surfaces of the second I-Beam flanges are dimensioned to nest within the opening defined by the top and bottom flanges of  
20 the first I-Beams.

13. A bridge according to claim 12, further comprising a deck surface fastened to the first or second I-Beams.

14. A bridge according to claim 13, wherein said deck surface is dimensioned to fit between the top flanges of the parallel rows of the first I-beams.

15. A bridge according to claim 14, wherein said deck surface has a thickness dimension selected to provide the deck surface with a top surface that is essentially flush  
30 with the top surfaces of the parallel rows of first I-Beams.

16. A bridge according to claim 13, wherein said deck surface is formed from a plurality of essentially planar modular plastic structural composite panels comprising a grooved side and an integrally molded tongue-forming side parallel to the grooved side, each side perpendicular to the plane of the composite panel and to the direction of travel,  
35 wherein:

each composite panel is formed from a mixture of (A) high-density polyolefin and (B) a thermoplastic-coated fiber material, polystyrene, or a combination thereof;

5 for each composite panel the grooved side defines a groove and the tongue-forming side is dimensioned to interlockingly engage a groove having the dimensions of the groove defined by the grooved side so that said plurality of composite panels form an interlocking assembly in which adjacent panels are joined tongue-to-groove; and

10 the grooved side and tongue-forming side of each panel are dimensioned so that said plurality of essentially planar modular plastic structural composites interlockingly assemble to distribute a load received by one assembly member among other assembly members.

17. The modular plastic composite of claim 1 or claim 9, wherein said composite comprises from about 20 to about 50 wt% of a polystyrene component containing at least  
15 about 90 wt% polystyrene and from about 50 to about 80 wt% of a high-density polyolefin component containing at least about 75 wt% high-density polyethylene (HDPE).

18. The modular plastic composite of claim 1 or claim 9, wherein said composite comprises from about 20 to about 90 wt% of a polymer component and from about 10 to  
20 about 80 wt% of thermoplastic-coated fibers, wherein said polymer component comprises from about 20 to about 50 wt% of a polystyrene component containing at least about 90 wt% polystyrene and from about 50 to about 80 wt% of a high-density polyolefin.

19. The modular plastic composite of claim 1 or claim 9, wherein said composite  
25 comprises from about 20 to about 90 wt% of a polymer component that is at least 80 wt% HDPE and from about 10 to about 80 wt% of thermoplastic-coated fibers.

20. The modular plastic composite of claim 17, characterized by exhibiting a compression modulus of at least 170,000 psi. and a compression strength of at least 2500 psi.  
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